Claims

1. A method of processing acoustic signals using the steps of:

- obtaining seismic signals from a plurality of receivers;
- identifying receiver functions within the acoustic signals;
- analyzing said receiver functions for velocity or moveout characteristics;
- using the result of said analyzing step to determine properties of multiple layers of earth located below said receivers.

2. The method of claim 1 wherein the plurality of receivers include receivers responsive to p-waves and receivers responsive to s-waves.

3. The method of claim 1 wherein the seismic signals include unchanged modes and converted modes of acoustic signals.

4. The method of claim 3 wherein the seismic signals include P-waves and PS - converted wave modes.

5. The method of claim 1 wherein the receiver functions are two-dimensional receiver functions including vertical components of seismic signals and radial components of acoustic signals.

6. The method of claim 1 wherein the receiver functions are two-dimensional receiver functions determined by a two-dimensional deconvolution or crosscorrelation of vertical

components of the acoustic signals and radial components of the seismic signals .

7. The method of claim 1 wherein the analyzing step includes the step of determining traveltime differences or an approximation of the traveltime differences between different modes of the seismic signals.

8. The method of claim 1 wherein the analyzing step includes the step of determining traveltime differences or an approximation of the traveltime differences between different modes of the seismic signals emerging at a single receiver location.

9. The method of claim 1 wherein the analyzing step includes the step of determining traveltime differences or an approximation of the traveltime differences between different modes of the seismic signals originating from a single location below the multiple layers.

10. The method of claim 7 wherein the step of determining an approximation of the traveltime differences between different modes of the seismic signals includes the step of calculating the traveltime differences in dependence of powers of slowness.

11. The method of claim 7 wherein the step of determining an approximation of the traveltime differences between different modes of the seismic signals includes the step of calculating the traveltime differences in dependence of powers of horizontal distance.

12. The method of claim 11 wherein the step of determining an approximation of the traveltime differences between different modes of the seismic signals includes the step of calculating the squared traveltime differences in dependence of powers of horizontal distance.

13. The method of claim 7 wherein the step of determining an approximation of the traveltime differences between different modes of the seismic signals includes the step of calculating the traveltime differences in dependence of powers of slowness.

14. The method of claim 1 wherein the step of determining properties of multiple layers of earth located below said receivers includes the step of determining at least one of the parameters of p-wave velocity, s-wave velocity, height/depth, or density of each of said multiple layers.

15. The method of claim 1 wherein the step of determining properties of multiple layers of earth located below said receivers includes the step of using a relation which express the product of p-wave velocity and s-wave velocity in a layer as functions of moveout characteristics and/or traveltime differences at the interface of said layer.

16. The method of claim 1 wherein the step of determining properties of multiple layers of earth located below said receivers includes the step of using a Dix-Krey type of relation.

17. The method of claim 1 wherein the step of determining properties of multiple layers of earth located below said

receivers includes the step of using travel time differences and differences in horizontal travel to provide two constraints in a step of determining p-wave velocity, s-wave velocity, depth/height or density of each of said multiple layers.

18. The method of claim 1 further including the step of correcting the receiver functions for normal moveout (NMO).

19. The method of claim 1 further including the step of migrating the receiver functions.

20. The method of claim 1 further including the step of migrating the receiver functions using the properties of multiple layers of earth located below said receivers.

21. The method of claim 1 wherein the analyzing step includes the use of a coherence measure.

22. The method of claim 1 wherein the multiple layers of earth include significant discontinuities above a converting interface at which an acoustic signal is at least partially converted from one mode into another.